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Barriers, emotions, and motivational levers for lifestyle transformation in Norwegian household decarbonization pathways

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Abstract
Meeting the Paris Agreement targets requires strong near-term climate change mitigation in all sectors of the economy. Increasing demand-side emission abatement efforts is one important area to pursue, yet there are significant barriers that must be overcome in order to realize its potential. We ask: What barriers may be hindering deep emissions reduction at the household level? What kinds of levers are available to achieve emission reductions? Based on an original and extensive qualitative dataset, our in-depth study of households in Bergen, Norway, shows that individuals perceive they are confronted with considerable individual, economic, and infrastructural barriers that prevent them from taking deep mitigation actions. Our results however also suggest that some barriers can be overcome with motivational levers such as the availability of more sustainable alternatives, support networks and by the positive emotions felt when having a positive impact on the environment. Other barriers are more difficult to overcome, pointing to the overarching lesson from our study that households will need to be forced or incentivized beyond voluntary efforts to achieve rapid and comprehensive decarbonization. The current policy approach, aimed mostly at nudging for voluntary mitigation actions, is wholly inadequate to achieve significant emission reductions. Our study indicates that households are open for increasingly including more "sticks" into climate policymaking. While there are significant challenges to individuals taking stronger mitigation action, these can be overcome by strengthening government policies targeting the patterns and, importantly, volumes of household consumption.

Keywords Climate change mitigation · Household carbon footprints · Climate policy · Demand-side mitigation

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1 Introduction

Reaching the Paris Agreement goal to limit global average temperature increase to well below 2 °C above pre-industrial levels and pursue efforts to limit temperature increase to 1.5 °C (UNFCCC 2015: 2–3), requires stringent emission reductions in all societal sectors. Neither current climate change mitigation policies nor the Nationally Determined Contributions (NDCs) under the United Nations Framework Convention on Climate Change (UNFCCC) are consistent with the goals set in the Paris Agreement (UNEP 2019; Höhne et al. 2020). Greenhouse gas (GHG) emission pathways consistent with a 2 °C world have already included most supply-side mitigation potential by 2050, meaning further mitigation beyond the 2 °C goal requires removal of GHGs from the atmosphere and scale-up of efforts in demand-side mitigation (Millar et al. 2017; Rogelj et al. 2015; Sanderson et al. 2016). A scale-up of demand-side mitigation would entail targeting GHG emissions from private consumption to a greater extent than what has up until now been the case due to perceptions of political infeasibility (Dubois et al. 2019). However, targeting household consumption to a greater extent might be more politically feasible than often assumed by policymakers and researchers (Moberg et al. 2019; Stern and Dietz 2020; Gilligan and Vandenbergh 2020).

Households can displace large amounts of GHGs through direct and indirect emissions from their consumption activities, particularly in the areas of mobility, housing, diet, and waste (Dietz et al. 2009; IPCC 2014: 66; Dietz 2014). As much as 72% of global GHG emissions can be ascribed to household consumption, the remaining share being related to public consumption (Hertwich and Peters 2009). Reducing emissions from household behavior therefore holds vast GHG mitigation potential, a potential, current climate policies only address to a limited extent (Moberg et al. 2019). If we accept that stringent demand-side emission reductions are an essential component of a move to a low-carbon/post-carbon society that achieves the Paris Agreement goals, then climate policies must to a greater extent aim towards reducing volumes of mobility (such as air travel, car use) and residential energy consumption and changing patterns of food consumption (such as eating less meat) (Moberg et al. 2019; Sköld et al. 2018; Dubois et al. 2019; Herrmann et al. 2020).

However, such focused—and potentially effective—demand-side options remain woefully unpopular in research and political communities. Addressing household GHG emissions has often been explicitly excluded in government climate policymaking (Wynes and Nicholas 2017). That said, a demand-side policy mapping carried out in Norway, Sweden, France, and Germany did reveal that many demand-side climate policies already exist, although they are insufficient to trigger lifestyle changes that may be required for achieving the Paris Agreement goals (Moberg et al. 2019). As one very recent study warned: "Much of the literature on mitigation pathways addresses technological and economic aspects of feasibility, but overlooks the behavioral, cultural, and social factors that affect theoretical and practical mitigation pathways" (Nielsen et al. 2020: 325). Adding to the challenge, Dickinson et al. (2009) admit that many high-impact actions available to households remain unpopular politically and perhaps even socially. Connolly and Prothero (2003) add that some consumers can even come to abdicate their responsibility for consumption and place it at the hands of energy or material suppliers.

In order to address this pesky nexus of demand-side options, lifestyles, barriers, and required behavioral change to decarbonize lifestyles, it is necessary to better diagnose which behavioral determinants should be targeted by policy intervention (Abrahamse et al. 2005: 283) and how to balance use of "carrots" and "sticks" to achieve necessary consumption

changes (Aall and Hille 2010; Herrmann et al. 2018; Moberg et al. 2019; Dubois et al. 2019; Herrmann et al. 2020). We ask: What barriers may hinder deep emission reduction at the household level? What kinds of levers are available to achieve emission reductions at the household level? To answer these questions, this paper analyzes semi-structured in-depth interviews with a selection of households in Bergen, Norway, that participated in the research project Household Preferences for Reducing Greenhouse Gas Emissions in four European High Income Countries (HOPE). Our results contribute to the understanding of household perceptions on individual climate change mitigation action in a high-income and high-consuming country context. Such knowledge may be important when forming policy recommendations for the next round of NDCs on how countries plan to meet the Paris Agreement goals.

2 Carbon, consumption, and the promise of household mitigation

A growing body of research suggests that household carbon reductions through behavioral schemes could be substantial. An interdisciplinary study of 16 action types concluded that implementing the most successful behavioral programs could reduce US household carbon emissions by 20% by 2020, an amount equal to all GHG emissions from France (Dietz et al. 2009). Similarly, one energy efficiency program in Oregon cut average household carbon dioxide emissions by 22% in 1 month primarily by publishing an "emissions calculator" that compared individuals' carbon footprints to that of their neighbors (Rabkin and Gershon 2007). A study of stationary energy-use in Norwegian households stipulates that putting a cap on the size of new residential homes can save up to 30% in energy-use for the next 30 years compared with a business-as-usual trend (Aall 2013). More recently and looking at Europe, Moran et al. (2020) project that changes in consumer practices and consumption patterns could reduce carbon footprints further beyond business as usual by roughly 25%. Levesque et al. (2019) even project that globally, adopting new, energy saving practices could reduce energy demand from buildings by up to 47% in 2050 and 61% in 2100 compared to a scenario following current trends.

However, another study considering high-income countries found that consumer-oriented mitigation policies tend to focus on low-impact actions, leaving a significant mitigation gap compared to what could be realized in demand-side mitigation (Wynes and Nicholas 2017: 7). If we are to realize the mitigation potential in the demand-side of the economy, we need to further explore how to overcome these barriers to accelerate household climate mitigation (Lorenzoni and Pidgeon 2006: 73), and catalyze insights from behavioral science and psychology about how to motivate households to change their practices and lifestyles (Allen et al. 2015; Bouman and Steg 2019; Schmitt et al. 2018; Attari et al. 2009). Moreover, initiatives directed towards individual behavior can easily fall prey to over-optimism and proposals that ignore barriers to adoption (Dubois et al. 2019). They may lastly misunderstand how households actually use energy or other services in the home, relying on "folk" knowledge, underestimating impacts of their own behavior, and improperly calculating their own energy consumption footprints (Kempton and Montgomery 1982).

More rigor can be brought to these efforts by examining the technical potential of targeting behavior (the emissions reductions potential if all possible behavior change occurs) and behavioral plasticity (the extent to which state-of-the-art programs can change behavior) (Dietz et al. 2009; Gilligan and Vandenbergh 2020). Promising aspects of this work include exploring and emphasizing different *types* of consumers, such as those who are boundedly

rational, predictably irrational, locked-in, or socially constrained (Shwom and Lorenzen 2012); the important role of *values* and *norms* which can act as intrinsic motivators for climate action (Steg 2016); and the possibility of social influence and *spillovers* in sustainable behavior (Van Der Werff and Steg 2018). Research also has noted the importance of accounting for policy plasticity (the extent to which organizations can adopt and implement behavioral programs) in analysis of climate mitigation initiatives. Interdisciplinary research is needed to refine and apply analytical frameworks for initiatives targeting individual behavior and translate the research into specific policy recommendations. Niamir et al. (2020: 1) concur in their recent assessment of the literature that "while households as agents of change increasingly become a crucial element in energy transitions, bottom-up mechanisms facilitating behavioral change are not fully understood." Wood et al. (2020: 2) add that research on carbon footprints needs to be better grounded in understanding the drivers of domestic consumption as well as "on accounting and responsibility for enacting change."

3 Research design: reflective household in-depth interviews in Norway

With these gaps in mind, we designed a study to examine the underlying drivers behind carbon footprints, barriers to more climate friendly lifestyles, and potential levers for reducing emissions in four mid-sized cities in Europe. Due to the trend of increasing urbanization, estimating that almost 70% of the world's population will live in cities by 2050 (UNDESA 2019), our study had an urban focus. We developed a mixed-methods study design involving three sequential interactions with households in Bergen (Norway), Umeå (Sweden), Mannheim (Germany), and Aix-en-Provence (France) as part of the HOPE research project. Original results of the third interaction with Norwegian households have yet to be published, and are presented in this paper. Norway is particularly important to examine given that policymakers have made very clear their official reservations as to not develop a consumer-oriented climate mitigation policy—a position that was clearly stated in the first Norwegian government green paper on how to reduce emissions by two thirds by 2050 (NOU 2006). A brief account of the HOPE household interactions is provided below.

Interaction 1 was a quantitative questionnaire to collect basic socio-economic, demographic, and consumption data to calculate household carbon footprints. Interaction 2 was a simulation game where participants were asked to reduce their carbon footprint by 50% by 2030. This goal represents the need for stringent, near-term mitigation measures (IPCC 2014). It also reflects the idea that high-income countries with corresponding high levels of historical consumption-related GHG emissions should accept a higher reduction burden than the average global burden. That said, questions of burden sharing among countries and sectors as well as how to divide policy-focus between production- and consumption-related sources of GHG emissions are up for debate (Page 2011). During the simulation game, households could choose from 65 mitigation actions in the sectors "food," "housing," "mobility," and "other consumption." These were presented as action cards, containing information about CO2e reduction, economic costs/savings, and possible health co-benefits. In the first round, participants were invited to choose "voluntary" measures. If participants failed to reach the 50% reduction goal in the first round, a second round was introduced where they had to select additional measures, imagining being forced by their government, until they reached the goal of 50% emission reduction. A total of 308 European households participated in Interactions 1 and 2. Interaction 3 involved semi-structured in-depth interviews with a sub-sample of

households that participated in Interactions 1 and 2. The purpose was to gather their thoughts and reflections on mitigation choices, and possibilities of implementing these measures in real life. This paper focuses on Interaction 3 with households of the Norwegian case (see Herrmann et al. 2018 for a detailed description of the research design of all three interactions, and Sköld et al. 2018 for the main results from the first two interactions).

We applied a purposive sampling with maximum variation ensuring that participating households differed meaningfully in terms of the gender, age, education, income, and nationality of their occupants, in addition to housing status (renter, owner), housing type (apartment, single house), household location (urban, suburban, rural), household size, and the presence of children (< 18 years) in the household (see Table A1 in Appendix). We made sure to cover extremes in terms of including households with high and low carbon footprints, and at least one "climate sceptic," one "climate expert," one that refused to reduce their footprint by half, and one that quickly reached the reduction goal. The principle of data saturation was applied to determine the sample size of Interaction 3 (Hennink et al. 2019). Saturation was reached by the 16th interview, since few new elements had emerged during the four preceding interviews. Each household was given a unique identifier which we refer to later in the study whenever presenting direct quotations.

We followed a reflective interview guide developed by our interdisciplinary team with expertise spanning medical and life sciences, behavioral science and psychology, political science, geography, media studies, and engineering. The guide consisted of five main sections and a series of open-ended and probing questions as well as short narratives and scenarios to react on (see A2 in appendix for an English short version of the interview guide). The in-depth interviews of Interaction 3 lasted between 54 and 104 min and were carried out via Skype and FaceTime by the first author in 2017. The interviews were transcribed verbatim and underwent two analytical approaches. First, a conventional content analysis was undertaken, supported by the software NVivo to systematically interpret the meaning of the data (Hsieh and Shannon 2005). In the analysis results were delineated by developing codes derived directly from the data, and grouped into content categories, systematically moving from what was literally in the text towards the latent content of that text, the latter involving a higher degree of interpretation than the former (Berg 2007).

The initial coding of data was carried out by the first author. The last author read the interviews and coded two interviews for the purpose of analyst triangulation, discussing and agreeing with the first author on codes. The second author grouped codes with a similar content into categories from which one central theme emerged that brought the categories together. The results were iteratively revisited and discussed between this paper's co-authors. Second, the first author carried out a directed analysis of the data based on the Sköld et al. (2018) results on which consumption areas are most critical for halving household GHG emissions. The barriers to and motivations for adopting changes mentioned in relation to the three consumption areas holding the biggest mitigation potential (mobility, food, housing) were noted, as well as specific reflections on policy changes that may support lifestyle changes in those areas.

4 Results

The first part of this section (4.1) presents the results from the conventional content analysis. It will focus first on the carbon-intensive nature of existing lifestyles, and the barriers to climate action and motivational levers for transformational change. The second part (4.2) presents the

results from the directed analysis, focusing on specific policy reflections of our informants across consumption areas with high mitigation potential.

4.1 Stronger incentives and policies are required to support lifestyle decarbonization

Based on the codes and the four categories, one core theme emerged in the analytical process: "Stronger incentives and policies are required to support household lifestyle decarbonisation." The four categories leading up to the theme contain concepts of perceived barriers and levers:

- Decarbonizing lifestyles is difficult and inconvenient;
- Climate change and decarbonization is intimate and emotional;
- Knowledge by itself is insufficient to catalyze change;
- Transformational levers do exist to overcome barriers and impediments.

These results are illustrated at a high level in Fig. 1 and elaborated in the subsections to come, organized according to analytical categories that also title each sub-section.

4.1.1 Decarbonizing lifestyles is difficult and inconvenient

In our interviews, although on a general level we frequently found positive associations connected to the prospect of a low carbon future, our interviewees strongly pointed to multiple barriers for consumption change, an overall barrier being our current lifestyle:

> Globally, [a low carbon future] could have a positive impact in the long term. It's an ideal world, but I am not the one who thinks we can do [it]. I'm not that optimistic.

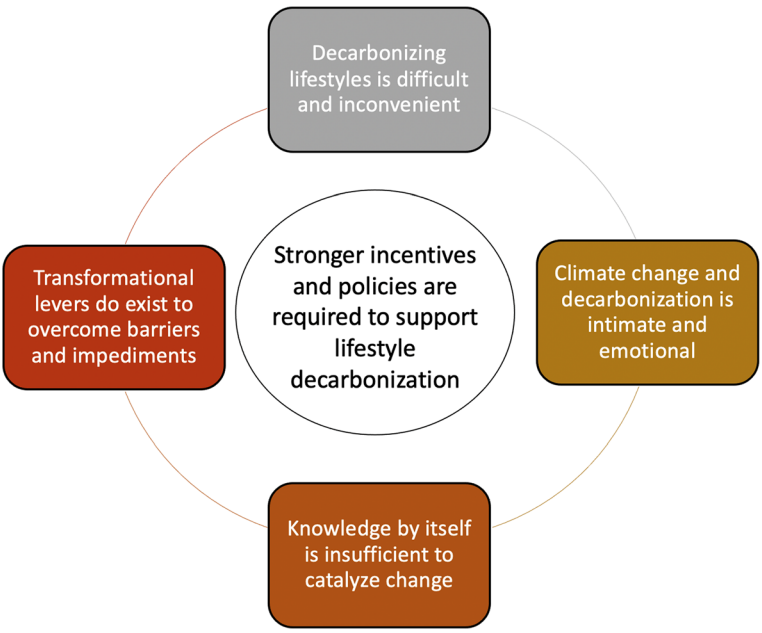

Fig. 1 Characterization of the barriers and motivations for lifestyle decarbonization in Norway. Core research finding (inner circle) and thematic categories (outer circle)

> [Consumption prevents this]. That such a big part of the world is rich, and that we have actually invented cars and planes, and these cannot become truly environmentally friendly in the foreseeable future.
> (Informant 0032).

Many interviewees reported lacking the capacity to implement changes due to time use of the changed behavior and difficulty with changing existing habits since forming new habits was perceived as hard work. Cost was one of the most frequently mentioned barriers to change in different areas of consumption: the high perceived cost of climate beneficial actions prevented change, and the comparative low cost of carbon-intensive actions. There was a sense in the interviews that while "we are all responsible" for acting on climate change, it is the government that must take the lead since we cannot count on individual action. Many also found it tough to be confronted by one's own unwillingness to change. Household reflections about food, housing, and mobility are most apt at illustrating these issues.

On the topic of food, statements would repeatedly reveal that it was difficult to imagine a diet involving less animal protein. Many interviewees felt it was not possible to be fully vegetarian, and that eating meat was natural or necessary to feel full:

> I believe that meat is an important part of a diet and I have a cohabitant who shares that opinion.
> (Informant 0023).

When asked "what do you think about becoming a vegetarian," many could not conceive of becoming a vegetarian or switching diets:

> It's interesting, but out of the question. It's a very distant thought in my world, I was raised with eating our animals, sheep and sometimes rabbits and chickens. So it's a very distant thought.
> (Informant 0032).

Difference of opinion internally in the household on what constitutes a proper diet was also a barrier to eating more vegetarian food:

> Personally, I can eat vegetarian food occasionally for dinner and such. But […] I won't get the whole family in on it […] Not that long ago, [my daughter] made such a vegetarian dish. And it was very good, but the boys did not see this as a dinner. There was no food in it. They felt hungry again. So I think there is a bit of ingrained skepticism that vegetarian food alone is not a proper dinner.
> (Informant 0036).

Others had "no plans" to voluntarily adopt a low-carbon diet for climate reasons: any such change would be purely health motivated:

> I don't have any plans to become a vegetarian or changing my diet. I see the youth, they are totally crazy. I see with my boy, with friends that are vegans and vegetarians […]. The thought is probably good. But I have asked them, they must have proteins [laughs] and yes, they eat beans [laughs]. It's possible of course, but I'm not a big fan of it even though I don't eat a lot of meat myself […]. Today we mainly sit around on our asses, and we don't really need all that energy like they did in the past […] so it's for those reasons, and I don't think of CO2 emissions when I eat a lot of fruit and vegetables. So it's

> really only wellness and health that is my motivation for not eating meat. (Informant 0026).

Even if meat was much more expensive, due to some sort of tax or climate legislation, some said they would still buy it because it is what they are used to:

> I think I'd still buy meat. Of course, I wouldn't buy a beef tenderloin as often, it's expensive enough already, but I probably wouldn't, perhaps I would think about it in the beginning, and then it would become normal like now. It is already twice as expensive in Norway to buy a tenderloin compared to Spain, for example, you live with it. You move on and you buy what you want.
> (Informant 0037).

Interviewees revealed similar barriers to change with lower carbon forms of housing. Barriers included unwillingness to move from rural areas to urban ones, or to smaller homes that may have lower carbon footprints, or to build a new and more sustainable home. This was coupled with views of purchasing passive homes, and the required investments for energy efficiency upgrades in their existing residence were too expensive. When asked for thoughts about moving to a more central location (and as a result reduce transport-related emissions), one informant responded:

> Absolutely out of the question. […]. We live twenty kilometers from Bergen city center. Rural, [we] run a farm. It seems possible that sometime in the future [we] may move a bit more central, but I can't imagine it. It's not a wish me and my husband have. […] it would probably be more environmentally friendly, but at the same time I think that living in a city isn't good for my health or the health of my children. And that's a choice we make.
> (Informant 0032).

Strong preference for living in their present home because it posited other qualities of more importance to them was another barrier for moving to a more climate friendly home:

> We had a discussion before last time we moved about where we wanted to live. Now we live in a place where we own our own kindergarten, and we have zero transport. We live in, it's like a small village in the city. We have many social activities and know our neighbors well. Lots of families with children. The outdoor area is car free. Big area for kids to play […]. We like our housing cooperative so much that we don't want to move. (Informant 0025).

The issue of costs of energy efficient homes was noted by several informants: "it sounds very nice you could say that I could save so and so much energy. But cost is an important barrier." (Informant 0028). Investment costs of more efficient sources of heating was an important barrier to efficiency upgrades in existing homes:

> Changing to a heat pump was something I imagined would be easy for me to do, but it's an investment so we haven't done that yet. And I don't know that we will do it either, but it's absolutely possible.
> (Informant 0023).

While economic support schemes for energy efficiency upgrades do exist and were acknowledged by many informants, the subsidies were often seen as insufficient:

> If there had been beneficial support schemes for those things. The problem is that I do a lot myself, and I've looked at those support schemes, such as support for removing oil furnaces and such. To get the support you'd have to use a company which costs a pork and a fortune, and if you can do it yourself, it costs something then as well, but you don't get any support then. So those support schemes are really just a joke. […] It's cheaper to do it yourself […] the same goes for energy efficiency upgrades and that whole package. (Informant 0026).

Finally, climate-friendly actions related to mobility such as flying less and avoiding car transport were perceived as difficult to adopt. Reasons included that it was easy and convenient to fly, and that flying was too cheap. Many interviewees believed that the only way to reduce air travel was to increase its cost or restrict the number of flights per person:

> Generally I think it would help if it cost more. That it wasn't so easy to travel abroad. Also in a way for my own sake, when I think oh it would be fun and it only costs NOK 1000 for a round trip and such. But it's a little difficult because it's so alluring to travel abroad and if you are travelling a great distance, then airplanes are absolutely unmatched. […] But […] it would be nice if [people] limited themselves so everyone […] had the opportunity to take a holiday every other year or so to the great abroad […]. It's very important to deal with this even though it might mean we only get that one flight every other year, I know it's a luxury, so I do it with some shame on the side. (Informant 0022).

Many informants also pointed out that it was difficult to give up air travel with their current job since it is a time-efficient travel mode:

> There is often a reason to fly, I'm not only doing it for a holiday. It's business trips and such, […] some have to travel for work, and then you often choose to go by plane. You do not drive to Oslo for example. You want to get from A to B in the fastest possible way. No, it's not easy to know what to do.
> (Informant 0024).

For some, air travel was also necessary to visit family living far away:

> I'm not from Norway so I fly home to North America once a year. And that isn't something I can stop doing. My mother lives there and I am an only child and she is not married, so I don't feel that I can stop visiting her. […] And then I fly a bit with my job. You know the seven and a half hours it takes to go by train to Oslo makes it impossible in a busy everyday life. It's sad.
> (Informant 0027).

Only more expensive plane tickets or serious wars would prevent Informant 0026's plane travels:

> I doubt our lifestyle is changing that much when it comes to vacations and things like that. […] As long as it's this cheap to fly and as long as there is no serious war then we'll travel by plane. […] the only thing that stops me is if plane tickets become more expensive.

Informant 0037 implied that they would rather give up their car than flying, it has become so key to their life: "Now I would rather give up the car than airplanes. […] it's very difficult to get to other countries without airplanes."

For many informants, however, the idea of giving up their personal car was unattractive since the existing public transport solutions were no good substitute due to poor coverage for solving daily logistics such as getting the kids to and from kindergarten, or enabling leisure activities:

> […] then we'd have to also give up the one activity we all love the most which is being on the mountain. Or at the cabin. We could reach local mountains, but going by bus to anything farther than the three closest mountains in Bergen is difficult. I've lived by one of the other mountains around Bergen, and there were, on Sundays that is, there were maybe two busses. You can't get there for a hike with a family on a weekend. So [public transport] is not good for enabling those leisure activities. And it would require incredible amounts of travel time to get to the mountain [by public transport]. […] we'd be a bit stuck in the city. And we don't like that.
> (Informant 0025).

> It's difficult where we live. We don't have good bus connections and such. So with kindergarten, we only had one car previously, and it was very hard to juggle pick-up and delivery to kindergarten with work and all that. And no busses pass us, so yeah. It was too difficult [with just one car].
> (Informant 0030).

The option of replacing their fossil fuel car with an EV was also seen as unfeasible by some until the technology has matured and better EV alternatives emerge:

> […] if there were good enough alternatives in EVs I'd consider it, but as things are today it's not an option. But if [government] says that they're gonna [only sell new EVs] by 2025 then the technology has to be at a level where good enough alternatives are available.
> (Informant 0023).

One informant questioned whether cars and planes can be environmentally friendly, and the lack of critical reflection on technological optimism related to mobility:

> […] we have green planes, environmentally friendly, right, it's just a bad joke. You can't sell a car or a flight and say it is good for the environment, that is, but I think many people in this country believe it [laughs]. But fair enough. I don't know, people probably believe in Santa Claus too. So I doubt there are that many people who are very reflected about [their choice of flying].
> (Informant 0026)

Another more overarching barrier to take action was that climate goals are set so far into the future. Informant 0031 said this works almost like a sleeping pillow that *stops* them from taking needed action in the present:

> I hear it myself, it's such a pessimistic way of thinking. But because it's so urgent now, and because everyone must join […] we should set goals that we think we can join in on now. And maybe not so far into the future. Because these deadlines that are set so many years into the future become like a resting pillow. Like, don't have to change now, not until this and that many years. So I

> don't think that's good enough, and then I get sad, I feel a little pessimistic. On behalf of Norway and the world. That we can't do this.

Most of our informants agreed that stronger government action is the only way to decarbonize lifestyles. In the words of Informant 0027: "I think many people will make decisions based on whether it's an easy choice to make. Which is why I think governments should just come in and put their foot down."

4.1.2 Climate change and decarbonization is intimate and emotional

Our second result is that household decarbonization is not only an issue of costs and benefits (cheap flights, affordable meat) or lifestyles (I need to fly for my job, or to see my family). It is also a topic that involves stark and at times contradictory and overwhelming emotions, which both shape rational responses and also lead to potential fear and anxiety. (Emotions can be a positive force as well, but we will return to that in Section 4.1.4). Many households were worried about the future some not only due to climate change itself but also due to the beliefs and reactions of other people:

> I think it's pretty scary, and we all know that the climate is changing. But I also think it's a little difficult to talk to people about this problem, because not everyone believe climate change is because of CO2. Many think it's a normal process, a natural process, and that scares me more.
> (Informant 0035).

Feeling hopeless about the situation was also prevalent, and for many this could be discouraging:

> […] you have those that know about it, but that actually just choose to not care. And then there isn't that much we can do about it really. We can put a lot of pressure on them [industry, businesses], but if they are sitting there when it comes down to it, and they are aware already of these changes and everything, then there isn't that much we can do about it.
> (Informant 0028).

The sense of hopelessness made it difficult for some to believe that making an effort matters:

> […] all childlike faith, hope for the future has really evaporated. You think you are screwed anyway, so why bother […] I do not have that much hope for the future in relation to climate, I don't. So my kids will probably grow up in a different reality than myself then.
> (Informant 0031).

Several informants worried about both the present and future generations:

> I'm afraid the climate is a factor that can cause [human civilization] to go in the wrong direction. As we see with drought, food problems in Sub-Saharan Africa can provide refugee flows to Europe […] And I am afraid that our children will face even more difficult situations and will be forced to make even tougher choices about how to prioritize.
> (Informant 0025).

Emotions—especially those of pessimism— can impact both footprints and possible responsive pathways. Informants discussed varying degrees of ambivalence and apathy—also types

of emotions—to the problem. Informant 0022 was discouraged by the size of the challenge: "it's incredibly challenging, […] you have to act on so many levels […] It can be quite discouraging." The complexity of mitigation globally led to some informants feeling apathetic:

> we are sitting here and would like to save some two million tons of CO2 in Norway, and then you know that the Chinese are opening a new coal-fired power plant at least once a week or two a week. Then it becomes like, the problem isn't here really, so for me it becomes a bit like that what's the point? But then that's kind of ostrich-like. Like, you're just moving blindfolded, eyes shut into the future, and off a cliff.
> (Informant 0026).

Even those expressing a wish that they took more action found the challenge too big for them to handle as an individual person:

> It's really sad, the climate is one of those things where you wish you could do more, but you're just one person it's limited how much one can do. And I wish governments could make more decisions for us. Because it's so important, and every day that passes is a waste.
> (Informant 0027).

Informant 0027 further doubted that government or any of the political parties in Norway could tackle the problem, adding to their despair and inaction:

> I don't think any of the [Norwegian political] parties make good choices. […] None of them, none of them are good at the environment. So I don't think the government will do anything until people care. And I don't think people have the capacity to care. And it's such a scary problem that you almost just want to forget about it.

There was a sense of belief that individual actions do not matter in the bigger scheme unless a critical mass follows suit.

4.1.3 Knowledge by itself is insufficient to catalyze change

A third result suggests that knowledge by itself is insufficient to overcome mitigation inaction. In some areas there is too much information for households to make meaningful decisions. Several interviewees reported confusion regarding what actions were good choices, and that information can be conflicting and vary over time:

> […] authorities say you should use this mode of transportation or that type of fuel. […] it shifts from one government to the next. It certainly isn't easy for us normal guys to know what's the right choice. Just look at diesel versus gasoline. Now we all know that we should drive EVs, by all means, but it isn't easy.
> (Informant 0024).

This makes it difficult to keep track of good alternatives and reduces trust in the information presented to households. We also found varying degrees of problem denial – in this case access to information is not the issue, but whether the information is accepted or denied. Most interviewees accepted that climate change was a serious problem affecting us all, but many shifted the blame to other countries or other people consuming more than themselves: "Why should we be so good, look at the Americans" (Informant 0029). Only informant 0037 questioned whether climate change is real or just a hoax:

> No, I said that last time too, I don't believe there's any global warming. I think it's just the money, cash money, that's what it's about […]. I still think the main reason for climate quotas and such have been made so people can earn money.

Some interviewees expressed other forms of climate denial, including questioning the gravity of the problem:

> […] I'm a bit divided over whether [climate change] is dangerous or not. Because, we see climate changes happening, it's always changed. […] But I don't know enough to see the big dangers of it.
> (Informant 0032).

Our data also suggested habits can trump new information even when it is relevant and not confusing since falling back into "old sins" was easy:

> […] it's a wake-up call. The whale with all those plastic bags inside. And then I also think about these […] fish with micro plastic things in them. And how clean is our food really. Like the farmed salmon, how full it is of crap and misery. So no, you get a wake-up call sometimes in the media and stuff like that. The media has an incredibly strong influence on what we think the next few days, the weeks. But, then it's easy to fall back into old sins. We want to do the best, and I think we want to do the best for our kids and they grow up to have good values around these things. But in a busy everyday life it's not always that easy.
> (Informant 0024).

A busy life means it is easy to continue with bad habits, despite "knowing better." Habits and routine can trump the ability for information or education to make much of a difference, in the absence of stronger incentives. Informant 0023 listed many things they could do to reduce their footprint, but in the end explained their inaction not as a case of lacking options for mitigation actions, but rather as a case of being "lazy" about it:

> Switching to a heat pump was something that I thought was easy to do, but it's an investment so we haven't done that yet. And I don't know if we're going to do either, but it's certainly possible then. Recycle 30% more of your waste. We haven't done anything about that either, but again we have the opportunity to compost. We really should […] I suppose it's probably laziness. […] That's it, it simply hasn't been high on the list of priorities.

Several informants said habits can prevent change, despite knowing more low-carbon options exist:

> I mentioned the example of one of our boys wanting meat-free days. […] We pretty much agree on that. But yes, when you're a family of five it's like being a small business where things are run on habit. It's like yes, yes we must have some meatballs then so everyone feels full, and yes, yes we have the drive to training.
> (Informant 0029).

4.1.4 Transformational levers do exist to overcome barriers and impediments

Finally, and positively, several factors can motivate change, including influencing agents and networks, inspirational examples, emotions, and convenience. Many households mentioned being shaped by influencing agents and networks. Friends were important influencing agents

for many interviewees: "it is clear that my friends have had a real influence [on me]." (Informant 0023). Others mentioned inspirational examples, in the sense of both negative events such as conflict and adversity, in addition to support found in collective action can motivate change:

> Conflict, adversity [inspires change]. I think inspiration, it doesn't have to be conflict it can also be something that inspires you to make a change for the better. […] At a micro level, if something gets harder, then it can inspire you to make a change. If something is difficult in your life, it can inspire you to make a change. If you get fired from work then it can inspire you to take an education and do something else. […] Doing things together can inspire people to make a change. When I made a shopping stop, I did it with a friend. We talked about it, then we both did it and it was a support. And I think it would've been more difficult without anyone to discuss it with. When I stopped eating meat, I stopped together with my then roommate. So I think support is important.
> (Informant 0027).

Others said seeing examples of how to live environmentally friendly can motivate some behavioral changes:

> Friends have influence. And TV, media, news and such […] I have friends that are environmentally conscious, for example. […] You look at the way they live and think that you can do some of the same yourself.
> (Informant 0034).

Furthermore, emotions can be a lever at promoting change, in that it can feel good to do low-carbon things, set examples, or inspire:

> We see when we have taken the train, we think it's fun and nice to do as a family and we enjoy travelling together, and it is easy to make some choices like that, ok we didn't fly all the way there. And we saved money, and also without flying for leisure we often save money too. […] we get really happy when we see that the choices we make don't have consequences for our quality of life.
> (Informant 00022).

Informant 0025 mentioned how "in a positive way, acting for the climate it makes me feel better. I feel more active with the environment in general, so I feel in a better position. I feel better about the future."

Several informants further mentioned avoiding negative emotions like a guilty conscience or a sense of shame from doing carbon intensive things can motivate change:

> Making decisions that are bad for the environment gives me guilty conscience. […] I try to travel less. We used to go on weekend trips, and I try to do less of that. Because I know that a weekend trip isn't very environmentally friendly.
> (Informant 0027).

Feeling shame can be quite productive in terms of triggering behavior change:

> […] I think it's good for us to feel some of that shame. For example, when one feels like oh no, I've deserved this because I've worked so hard, then I feel a bit like you haven't deserved anything, you have a safe job and a solid income and you have very small problems in your life. There are many people out there who actually really deserve it. So

> yes, it's important to feel [some shame].
> (Informant 0022).

Adding to this, Informant 0031 pointed out that we generally want to avoid being seen in a negative light by others: "being a carbon pig or climate laggard isn't something you want to associate yourself with."

Finally, convenience, in terms of availability of positive actions, and inconvenience of negative actions, was frequently mentioned as important motivation for low-carbon actions:

> Generally accommodating [change]? Availability. Thinking of food and transport. Then availability is important, an important factor. In some other areas I'd say cost. Like getting people to [avoid something], then cost will be an important factor.
> (Informant 0025).

The economic inconvenience of for example paying rush-time fees and parking fees can also motivate more low-carbon means of transportation:

> I either take the fun [light-rail train] which is over-crowded and has far too little space. Or I wait until after 9am. Or before 3pm. But right, it costs to park in the city and you're a bit stingy with money spent on that. Then the better choice becomes taking public transportation.
> (Informant 0024).

4.2 Policies for accelerating lifestyle decarbonization

Drawing from the directed analysis of our dataset, Table 1 summarizes the interviewees' perceptions of barriers to and motivators for change related to specific consumption areas, accompanied by interviewees' reflections on which changes in policy might facilitate low-carbon practices in those areas of consumption.

A general result in terms of barriers to low-carbon actions was how cheap and convenient it was to choose the "bad" alternatives. Choosing the "good" alternatives was perceived as too costly and often impossible in practice due to poor availability/infrastructure. Motivational levers included making the low-carbon options comparatively cheaper to the "bad" alternatives and securing availability of good alternatives. Reflections on policies for addressing the barriers and taking advantage of the motivational levers pointed to the need for a combination of measures that reduce the availability of bad options, introduce economic sanctions on GHG-intensive activities, at the same time as making it economically beneficial to adopt low-carbon actions. The need for significant investments in infrastructure and availability of low-carbon options were also stressed, since in many cases it simply became too difficult finding a low-carbon alternative. In several consumption areas, there was also a need for combining strong incentivizing measures with targeted information campaigns that explain the environmental and climate impact of different goods, services, and actions.

5 Discussion and conclusion

Households will undoubtedly shape future emissions pathways (and futures) in complex yet meaningful ways. The prospect of achieving drastic reductions in carbon footprints, however,

Table 1 Household reflections on policies for overcoming barriers for lifestyle decarbonization[a]

Consumption category	Sub-category	Barriers	Motivational levers	Policy reflections
Mobility	Aviation	- "Normal" to travel by plane, traveling as a treat -Air travel is cheaper than alternatives -General unawareness of climate impact of air travel -Alternatives too time consuming -Maintaining social relationships requires flying -Reluctance to give up/sacrifice traveling	-Shame and guilty conscience -Improved awareness of aviation climate impact -Availability of good transport alternatives -Increased cost could make it less attractive -Other concerns: fear of terror -Change in life situation can facilitate fewer but longer journeys -Flying less is good for health since it reduces air pollution	- Reduce comparative ease and accessibility of air travel - Comparatively increase cost of air travel through progressive taxes hitting frequent flyers most - Inform public of climate impact; general unawareness/confusion - Need force to reduce air travel, unwillingness to stop flying without external push - Encourage replacing plane on possible distances - Change beneficial depreciation rules for aviation - Improve alternative infrastructure
	Car	- Car necessary to make the day work: flexibility - Time-use of alternative transportation - EV technology not mature enough - Lack of alternatives to car use due to location of residence and services	- Reduced monthly expenses with reduced/no car - EV good alternative - Economic benefits - Car-sharing ring good alternative to ownership of car - Reducing car use provides cleaner air and improves health	- Keep/scale up EV benefits - Improve support for and development of alternatives to car - Prioritize urban settlements with low car dependence - Use toll road and parking restrictions in a just way
	Train	- Too expensive compared to plane - Poor infrastructure and lack of availability as an option - Time-use compared to plane	- More comfortable than traveling by plane - More convenient than plane when train is an alternative - Good for health since it pollutes air less	- Improve internet and phone connection on train to increase commuting attractiveness - Make trains comparatively cheap to air travel
	Bus	- Unattractive due to high cost - Poor coverage and supply - Over-crowdedness	- Comfortable alternative to car: requires less focus/concentration - Safer alternative to driving a car	- Increase capacity and coverage (weekend, areas) - Invest in and develop more flexible solutions

Table 1 (continued)

Consumption category	Sub-category	Barriers	Motivational levers	Policy reflections
		- Loss of flexibility compared to driving - Often takes longer time than driving	- Good coverage and availability - Good for health since it pollutes air less	- Public transport an alternative to car when forced to change - Reduce price compared to driving a car
	Walking/cycling	- Geography and topography (hills and distance) makes cycling and walking difficult - Time use barrier to cycling/walking - Logistics barrier to cycling - Poor city planning/infrastructure makes cycling unattractive/unsafe - Rainy weather barrier to cycling	- E-bike a good alternative - Restricted parking opportunity for car - Reduction of climate and environmental impact - Feels good to cycle - Cycling is good for physical health - Walking is good for physical health	- Improve infrastructure - improved city planning to reduce sprawl between kindergarten, school, home and work
Food	Less meat	- Difficult covering nutritional needs with vegetarian diet - Meat too cheap compared to vegetarian options - Poor vegetable selection during winter - Family not onboard - Do not want to be "difficult" - Personal belief that meat is natural - Personal choice what to eat - Lacking knowledge on alternatives to meat	- Do not need meat everyday - Increasing societal acceptance for vegetable-based diets - Vegetarian food is tasty - Animal welfare motivation for reducing meat - Climate and environmental impact motivation for reduced meat consumption - Higher price on meat would encourage more vegetable-based diet - Reduced access to meat could force attitude change - Health benefits of consuming less meat - Feels good to eat less meat	- Information campaigns on vegetable-based diets for inspiration and myth-busting - Increase cost of meat - Introduce labeling scheme of food with environmental impact
	Less frozen food	- Difficult to keep quality of food without freezing	- Fresh food is healthy	- Regulation supporting local farmers - Price environmental externalities of food transportation/freezing

Table 1 (continued)

Consumption category	Sub-category	Barriers	Motivational levers	Policy reflections
				- Introduce labeling scheme of food with environmental impact
	More local food	- Small-scale farmers pushed out by large-scale farmers - Too expensive - Poor selection - Mostly available in specialist shops (too time consuming) - Too fancy for picky eaters	- Improved quality compared to long-traveled food - Accessibility and ease would encourage purchase	- Regulation supporting local farmers making it more broadly available - Price environmental externalities of food transportation - Introduce labeling scheme of food with environmental impact
	More organic food	- Small-scale farmers pushed out by large-scale farmers - Too expensive - Poor selection - Mostly available in specialist shops (too time consuming) - Poor quality - Gives lower yield than conventional - Conflicting information on benefits of organic food	- Accessibility and ease would encourage purchase - Information on benefits compared to conventional food - Organic food is healthy	- Regulation supporting organic farming making it more broadly available - Introduce labeling scheme of food with environmental impact
Housing	Energy use and energy solutions	- Investment cost of improved solutions - Unwilling to give up comforts - Negative esthetic impact of solar barrier to installing - Being a renter, not owner - Knowledge of what the options are and how to do it - Lack of sun barrier to solar - Access to cheap alternatives such as firewood - Decentralized ownership of RE barrier to uptake due to conflicting interests with energy companies	- Increased cost of energy motivates change - Clean sources of energy bring down air pollution and is good for health	- Improved financial support mechanisms for upgrades - Improved information support mechanisms for upgrades - Facilitate good schemes for decentralized RE structure

Table 1 (continued)

Consumption category	Sub-category	Barriers	Motivational levers	Policy reflections
	Building construction	- Investment cost of efficiency upgrades - Negative esthetic impact of efficiency measures - Being a renter, not owner - Knowledge of options and how to do it	- Economic gain motivation for efficiency upgrade - Increased cost of energy - "Other" conditions such as pest invasion and noise pollution	- Increased financial support mechanisms for efficiency upgrades to existing buildings - Improved information support mechanisms for upgrades
	Moving to low-carbon residence or a more central location	- Unwilling to move from existing residence due to attachment - Too expensive to move	- Changes in life-situation sometime in the future	

Source: Authors, based on the household interviews. [a] This part of the analysis was deductive and took as point of departure the biggest sources of GHG emissions from the simulation game results for each consumption category (see Sköld et al. 2018)

remains uncertain and depends on choices made in the areas of mobility, food, energy use, and the location of residence. During the HOPE simulation game, households were asked to choose up to 65 different mitigation actions across the dimensions of food and recycling, housing, mobility, and other consumption. The voluntary round of the simulation game typically led to a 25% reduction of the households' carbon footprint, and further emission reductions mostly took place in the "forced" round of simulation 2 (Sköld et al. 2018). The chosen actions in the voluntary round were characterized by incremental efficiency improvements such as eco-driving or substituting local public transport with walking and cycling instead of more substantial changes like reducing the number of intercontinental flights or giving up private cars. For food, the most popular actions were to buy goods with less packaging, rather than to become a vegetarian. A negative relationship was observed between the CO2e reduction potential associated with each action and participants' willingness to implement said action (Sköld et al. 2018).

Our analysis of the in-depth interviews with households in Bergen having participated in the HOPE simulation game suggests the barriers for lifestyle decarbonization outweigh motivational factors. Relying on voluntary actions in the absence of stronger policy incentives is insufficient as a strategy for realizing the GHG mitigation potential of dealing with levels of consumption in high-income countries. We identified time and effort constraints, economic costs, unavailability of good alternatives, habits, and negative emotions (apathy and hopelessness) as well as societal norms to be the main perceived barriers for households to implement radical changes to their lifestyles voluntarily. According to the results, decarbonizing lifestyles will likely require strong incentives, and in some cases restrictions, to mitigate the bulk of consumption-related GHG emissions. This difficulty of changing lifestyles voluntarily is confirmed in the literature. Schanes et al. (2016: 1036) note because "consumption is a major component of shared societal and cultural norms and can contribute to a sense of belonging barriers to consuming less include the difficulty of establishing everyday routines and habits and concerns with equality and fairness." In the environmental social psychology literature, norms are often found to have very strong influence on decisions (Dietz and Whitley 2018; Farrow et al. 2017; Steg 2016). This fits well with our results in the sense that households reported difficulties in finding time and energy to establish new climate-friendly routines. Wynes and Nicholas (2017: 6) also confirmed this point in their study, noting "even knowledgeable and willing individuals may not reduce meat intake or adopt other high impact actions if cultural norms or structural barriers act as obstacles."

Negative emotions, such as apathy and hopelessness, were also barriers for more sustainable lifestyle changes. One explanation for these emotions might be a low level of self-efficacy (Bandura 1977), meaning people do not believe that they or on a group level (group-efficacy) are able to carry out a climate-friendly action or that it will have the intended impact. For sustainable lifestyle choices, self-efficacy has been identified to be an important predictor (Niles et al. 2016; White et al. 2011). Moreover, our results seem to support the notion in social psychology that apathy over and inaction on climate change is not always a consequence of information or comprehension deficits, but it could rather be explained by a conflict between personal interests formed by group identities and acting on knowledge for collective welfare that may contradict these interests (Kahan et al. 2012). Information by itself is then insufficient to overcome mitigation inaction, especially since people are very good at selective engagement with information suiting their personal interests and ignoring the rest (Golman et al. 2016). This reaction is also known as the "ostrich effect." Overwhelmed by negative information,

people can feel paralyzed and start ignoring certain information (Haltinner and Sarathchandra 2018). This observation goes in line with the notion of cognitive dissonance where individuals may rationalize, underplay, or distort information to suit their personal interests and reduce the psychological discomfort resulting from holding contradictory beliefs or desires (e.g., choosing climate action vs. comfort or pleasure) (Schrems and Upham 2020). While learning about the seriousness of climate change and the mitigation potential of household actions may be insufficient to change decisions, a lack of knowledge can also (paradoxically) lead to ineffective actions (Attari et al. 2010).

Carbon-intensive modes of transportation such as air travel might be an interesting example of that: our informants accepted it is one of the biggest single contributors to their carbon footprint but reductions in this area were very challenging. Perhaps the dominant technology optimism in society at large and inherent in our climate policies could help explain why, since policies for substantial volume reductions are lacking (Moberg et al. 2019). Informant 0026 expressed a disbelief in environmentally friendly technology fixes for planes and cars. "Myths" about technology fixes, as in the case of air travel where promises of "climate friendly" electric planes, could have a stalling effect on climate policy development (Peeters et al. 2016). An important part of the climate policy solution, as indicated by our informants expressing the need for this in different contexts, is an increased focus on volume reduction in private consumption. Somewhat perversely, the greater the reduction potential of mitigation actions, the fewer households were willing to implement them (Sköld et al. 2018). Actions with greater mitigation potential reflect greater lifestyle changes and challenges for adoption. It is perhaps then not surprising a recent survey found that participants responded negatively to statements that individuals should take mitigation actions, finding it more palatable that other actors such as industry and businesses should be the ones taking action (Palm et al. 2020).

Our results point to several motivational levers that could lead to potentially transformational lifestyle changes. These include easing access to low-carbon actions, and decreasing access to carbon-intensive actions, influencing agents and networks of support, the power of following inspirational examples, feeling good about helping the environment or contributing to a more sustainable future, and negative emotions such as shame and guilt as behavioral regulators. While experiencing such negative adaptive emotions could lead to no change if the process of implementing the change becomes too complicated, such emotions have at the same time been found to be potent motivators for initiating reflection on a need for changing behavior (Lickel et al. 2014), an important first step of transformational change. Emotional levers can be grounded in intrinsic motivation (for the sake of the climate/environment), or extrinsic motivation (to receive a higher social/moral status, or to be similar to friends/peers). These findings are supported by the literature, where psycho-social factors, such as the willingness to sacrifice, have been identified to be the most important drivers for climate-friendly behavior (Thaller et al. 2020).

Our research, moreover, points the way towards emerging gaps and future research needs. For example, our analysis has been based on in-depth interviews with a sample of households in Bergen, Norway. Are our results compatible with larger sample sizes in Norway, Europe, or other parts of the world? Is it consistent with quantitative work looking at stated preferences, choice experiments, or pro-environmental values through large-scale surveys? Does our qualitative work suggest hypotheses for surveys usually grounded in social psychology? Other questions not answered in this paper are if and how people relate to trade-offs: do they weigh up reductions in one area against reductions in other areas? What factors influence which mitigation actions people prioritize? These are questions for future research to address.

Household decision-making and behavioral change is neither the silver bullet of climate policies, nor purely a consequence of climate policies. Households demand goods and services that propel economic development and consequently drive emissions, yet they also reflect broader patterns of infrastructures, technologies, organizations, markets, and practices that could be harnessed for near-term GHG emission reduction (Wilson et al. 2019). There is a duality, temporality, and reversibility to their potential to become either active agents of decarbonization or aggressive culprits accelerating emissions. The results of this paper suggest that overcoming barriers for lifestyle decarbonization requires stronger government action targeting demand-side mitigation by increasing accessibility of low-carbon alternatives for diets, mobility, and household energy use, in addition to policies rendering carbon-intensive actions less accessible. While there are significant challenges to households and individuals taking stronger mitigation action, these challenges can be overcome by strengthening government policies targeting the patterns and volumes of private consumption.

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